REMARKS

Reconsideration and allowance of the present application are respectfully requested in view of the following remarks.

Claims 1, 3 and 8-11 have been amended. Claims 2, 4 and 5 have been cancelled without prejudice or disclaimer. No new matter is included. Accordingly, claims 1, 3 and 6-20 are pending in the present application.

Claim Rejections Under 35 U.S.C. § 103

Claims 1-20 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Marcantonio (U.S. Patent No. 6,006,170, hereinafter "Marcantonio") in view of Winograd (U.S. Patent No. 4,156,920, hereinafter "Winograd"). The rejection is traversed at least because Marcantonio and Winograd, whether considered individually or in combination, do not disclose or provide any reason for Applicant's claim 1 features of inputting a predefined number N of samples per one cycle, said predefined number N being a power of two; or computing a parameter with a discrete Fourier transform algorithm optimized on the basis of fixed coefficients that correspond to the predefined number N of samples per cycle.

Exemplary embodiments of Applicant's disclosure relate to a control device which can improve response time, and which can provide an adjustable arrangement that can be configured according to an operating environment due to an optimized algorithm in Fourier transformation. For example, an optimal sample rate can be chosen to increase a speed of calculation of a Fourier transformation of input data of the control device. In an exemplary embodiment, a sample rate of 32 is chosen,

which can lead to eight different non-zero values for sine and cosine functions expressed as:

r[0]=cos(1*pi/16);

r[1]=cos(2*pi/16);

…

According to exemplary embodiments, the control device can increase computing speeds by sealing the sine and cosine functions into integer form using factor 2^{14}(16384). The eight different non-zero values for the sine and cosine functions can be expressed as:

r[0]=cos(1*pi/16)*16384;

r[1]=cos(2*pi/16)*16384;

…

Accordingly, the control device can, for example, optimize a basic algorithm using comprehensive consideration of the coefficient r. The optimization can include eliminating calculations for trigonometric functions, discarding multiplication by zero, and simplifying multiplications by -1 or 1 by merely changing or retaining the sign of the sample values. The optimization can also include locating individual equations including a common factor r and consolidating the equations into multiplication by combined sums.

The foregoing embodiments are broadly encompassed by claim 1, which recites an automatic control device, comprising, *inter alia*,

> an input means being arranged to input a predefined number N of samples per one cycle; and said predefined number N being a power of two and
>
> a computing means being arranged to compute the parameter with a discrete Fourier transform algorithm optimized on the basis of fixed coefficients that correspond to said predefined

number N of samples per cycle.

Marcantonio and Winograd, whether considered individually or in combination, do not disclose or provide any reason for combining their features to provide an automatic control device as recited in Applicant's claim 1.

Marcantonio discloses a computer-based method for ascertaining anomalies in an electric motor. In Marcantonio, a set of Fast Fourier Transforms of supply current waveforms are computed and processed for a motor known to be in a normal condition, and clusters of vectors related to normal conditions are formed. A single input sample may then be read, processed with a FFT, and checked whether it is inside any of the formed clusters. If not, a warning is given.

Marcantonio is not concerned with optimization of a FFT, or with adjusting sample rate in any way to implement FFT optimization. In Marcantonio, a known FFT is computed based on a training set of a "healthy" motor (see, for example, Fig. 1, step 2) and a single input sample (see, for example, Fig. 1, step 7). Marcantonio does not disclose input means arranged to input a predefined number of samples per cycle, the predefined number of samples being adjusted to optimize a discrete Fourier transform algorithm for computing the parameter.

In addition, Marcantonio does not disclose any optimization made on the FFT sets. Neither does Marcantonio disclose any adjustment made to sample rate in order to achieve any FFT optimization. Marcantonio does not disclose a mechanism of using fixed coefficients that correspond to the number of samples to implement an optimization. As a result, Marcantonio does not disclose computing a control function parameter with a discrete Fourier transform algorithm optimized on the basis of fixed coefficients that correspond to said predefined number of samples

per cycle.

The above-noted deficiencies of Marcantonio are not remedied by the Winogard document. The Winogard document discloses a computer system architecture for performing nested loop operations to effect a discrete Fourier transform. The computer system of Winogard discloses a complex configuration of registers that employ three system memories.

Winogard does not disclose a device inputting a predefined number N of samples per cycle, said predefined number N being a power of two. In Winogard, a value "N" is chosen for the transform which is separable into a plurality of mutually prime factors (n1) chosen from the group consisting of 2, 3, 4, 5, 7, 8, 9, 13 and 16. It is explicitly stated by Winogard that the value "N" chosen must meet this criteria (See column 7, lines 60 to 62).

In column 3, lines 65-69 of Winogard, a known algorithm of Cooley/Tukey is discussed for a particular class of N values which are a power of 2. However, in lines 30 to 38 of column 3 Winogard explicitly discloses problems associated with having a period that is equal to N times the sampling time, and provides reasons why limitations from using values that are powers of two are not acceptable. The exemplary value of N used in embodiments of Winogard is 60, which is notably not a power of 2. Accordingly, Winogard teaches away from using a number of samples which is a fixed power of two for measured values of cyclic voltage and/or current.

Thus, Winogard does not disclose Applicant's claimed combination which includes, for example, computing means arranged to compute the parameter with a discrete Fourier transform algorithm optimized on the basis of fixed coefficients that

correspond to said predefined number N of samples per cycle, the predefined number N being a power of two.

In view of the foregoing, claim 1 is patentable. Claims 3 and 6-20, because of their dependency from claim 1, and/or because they include distinguishing features similar to those of claim 1. Claims 2, 4 and 5 have been cancelled without prejudice or disclaimer.

Claims 1-20 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Rahman ("Power, Speed and Area Optimization of FFT Processors", CSE 450: Design and Analysis of Algorithms, hereinafter "Rahman") in view of Winograd. The rejection is traversed at least because Rahman and Winograd, whether considered individually or in combination, do not disclose or provide any reason for Applicant's claim 1 features of inputting a predefined number N of samples per one cycle; said predefined number N being a power of two; or computing a parameter with a discrete Fourier transform algorithm optimized on the basis of fixed coefficients that correspond to the predefined number N of samples per cycle.

The Examiner has conceded in the Office Action that Rahman does not teach or suggest an input means being arranged to input a predefined number of samples per cycle, or a computing means using a discrete Fourier transform algorithm optimized on the basis of fixed coefficients. The Examiner relies upon Winograd as allegedly remedying those deficiencies of Rahman.

As noted above with regard to the obviousness rejection over Marcantonio and Winogard, Winogard teaches away from using a predefined number N of samples, the predefined number N being a power of two, for measured values of

cyclic voltage and/or current. In addition, Winogard does not disclose computing means arranged to compute a parameter with a discrete Fourier transform algorithm optimized on the basis of fixed coefficients that correspond to said predefined number N of samples per cycle.

In view of the foregoing, claim 1 is patentable. Claims 3 and 6-20 are patentable either because of their dependency from claim 1, or because they include distinguishing features similar to those of claim 1. Claims 2, 4 and 5 have been cancelled without prejudice or disclaimer.

CONCLUSION

From the foregoing, further and favorable action in the form of a Notice of Allowance is respectfully requested and such action is earnestly solicited.

In the event that there are any questions concerning this Amendment, or the application in general, the Examiner is respectfully requested to telephone the undersigned so that prosecution of present application may be expedited.

Respectfully submitted,

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